CONTENTS

SEPTEMBER 1995 VOLUME 131 NUMBER 1

Tansley Review No. 84 Physiological ecology of cyanobacteria in microbial mats and other communities. By LUCAS J. STAL 1

Apoplastic permeability of sclerotia of *Sclerotium rolfsii*, *Sclerotium cepivorum* and *Rhizoctonia solani*. By NICOLA YOUNG AND ANNE E. ASHFORD 33

Dynamics of thermogenesis and structure of epidermal tissues in inflorescences of *Arum maculatum*. By EDITH BERMADINGER-STABENTHEINER AND ANTON STABENTHEINER 41

Impact of a fungal pathogen, *Colletotrichum coccodes* on growth and competitive ability of *Abutilon theophrasti*. By ANTONIO DITOMMASO AND ALAN K. WATSON 51

Endophyte infection effects on stomatal conductance, osmotic adjustment and drought recovery of tall fescue. By A. A. ELMI AND C. P. WEST 61

Quantitative imaging of chlorophyll fluorescence. By STEPHEN A. ROLFE AND JULIE D. SCHOLES 69

Leaf growth of hybrid poplar following exposure to elevated CO_2. By SIMON D. L. GARDNER, GAIL TAYLOR AND CREANA BOSAC 81

Increased growth efficiency of *Quercus alba* trees in a CO_2-enriched atmosphere. By RICHARD J. NORBY, STAN D. WULLSCHLEGER, CARLA A. GUNDERSON AND CHRISTOPHER T. NIETCH 91

Effects of CO_2 enrichment, leaf position and clone on stomatal index and epidermal cell density in poplar (*Populus*). By R. CEULEMANS, L. VAN PRAET AND X. N. JIANG 99

Uptake of $^{15}NO_2$ by sunflower (*Helianthus annuus*) during exposures in light and darkness: quantities, relationship to stomatal aperture and incorporation into different nitrogen pools within the plant. By HANS-JOSEF SEGSCHNEIDER, JÜRGEN WILDT AND HILMAR FÖRSTEL 109

Secondary thickening in roots of *Arabidopsis thaliana*: anatomy and cell surface changes. By LIAM DOLAN AND KEITH ROBERTS 121

Root-induced iron oxidation, pH changes and zinc solubilization in the rhizosphere of lowland rice. By G. J. D. KIRK AND J. B. BAJITA 129

Estimates of fungal biomass in Scots pine stands on an urban pollution gradient. By A. M. MARKKOLA, R. OHTONEN, O. TARVAINEN AND U. AHONEN-JONNARTH 139

OCTOBER 1995 VOLUME 131 NUMBER 2

Differential response of leaf conductance, carbon isotope discrimination and water-use efficiency to nitrogen deficiency in maritime pine and pedunculate oak plants. By JEAN-MARC GUEHL, CHRISTINE FORT AND ANDRÉ FERHI 149

Field study of leaf photosynthetic performance by a Mediterranean deciduous oak tree (*Quercus pubescens*) during a severe summer drought. By C. DAMESIN AND S. RAMBAL 159

Interactions between drought and elevated CO_2 on osmotic adjustment and solute concentrations of tree seedlings. By T. J. TSCHAPLINSKI, D. B. STEWART AND R. J. NORBY 169

Modelling pea (*Pisum sativum*) root growth in drying soil. A comparison between observations and model predictions. By TEZERA TSEGAYE, C. E. MULLINS AND A. J. DIGGLE 179

Flood-induced leaf elongation in *Rumex* species: effects of water depth and water movements. By M. BANGA, C. W. P. M. BLOM AND L. A. C. J. VOESENEK 191

Fructan exohydrolase activities from *Lolium rigidum* that hydrolyze β-2,1- and β-2,6-glycosidic linkages at different rates. By G. D. BONNETT AND R. J. SIMPSON 199

Reorganization of the endoplasmic reticulum in pea leaf epidermal cells infected by the powdery mildew fungus *Erysiphe pisi*. By CALUM P. LECKIE, JAMES A. CALLOW AND JONATHAN R. GREEN 211

Responses of pine needle endophytes to air pollution. By MARJO L. HELANDER 223

Exposure of spring wheat (*Triticum aestivum*) to ozone in open-top chambers. Effects on acyl lipid composition and chlorophyll content of flag leaves. By ANNA STINA SANDELIUS, KRISTINA NÄSLUND, ANDERS S. CARLSSON, HÅKAN PLEIJEL AND GUN SELLDÉN 231

A process-oriented explanation of the nonlinear relationship between grain yield of wheat and ozone exposure. By HÅKAN PLEIJEL, LENA SKÄRBY, GÖRAN WALLIN AND GUN SELLDÉN 241

Root hair length determines beneficial effect of a *Glomus* species on shoot growth of some pasture species. By P. F. SCHWEIGER, A. D. ROBSON AND N. J. BARROW 247

Chitinolytic activities of *Eucalyptus pilularis* and *Pinus sylvestris* root systems challenged with mycorrhizal and pathogenic fungi. By A. HODGE, I. J. ALEXANDER AND G. W. GOODAY 255

Nitrogen metabolism in the ectomycorrhizal fungus *Hebeloma crustuliniforme*. By ALI M. QUORESHI, IFTIKHAR AHMAD, DAVID MALLOCH AND JOHAN A. HELLEBUST 263

Water relations in lichens at subzero temperatures: structural changes and carbon dioxide exchange in the lichen *Umbilicaria aprina* from continental Antarctica. By BURKHARD SCHROETER AND CHRISTOPH SCHEIDEGGER 273

REVIEWS 287

NOVEMBER 1995 VOLUME 131 NUMBER 3

Assessment of photosynthetic radiation-use efficiency with spectral reflectance. By JOSEP PEÑUELAS, IOLANDA FILELLA AND JOHN A. GAMON 291

A three-dimensional representation of the relationship between penetration of u.v.-B radiation and u.v.-screening pigments in leaves of *Brassica napus*. By CAMILLA M. ÅLENIUS, THOMAS C. VOGELMANN AND JANET F. BORNMAN 297

Mesophyll structure during leaf development in *Ballota acetabulosa*. By G. K. PSARAS AND S. RHIZOPOULOU 303

The influence of CO_2 concentration on stomatal density. By F. I. WOODWARD AND C. K. KELLY 311

Exudation rate and hydraulic conductivity of maize roots are enhanced by soil drying and abscisic acid treatment. By JIANHUA ZHANG, XIAOPING ZHANG AND JIANSHENG LIANG 329

A rapid change in ozone resistance of *Plantago major* after summers with high ozone concentrations. By A. W. DAVISON AND K. REILING 337

Short-term exposure to atmospheric ammonia does not affect low-temperature hardening of winter wheat. By JOHANNES M. A. M. CLEMENT, JAN HENK VENEMA AND PHILIP R. VAN HASSELT 345

Axenic *in vitro* nitrogen and phosphorus responses of some Dutch marsh orchids. By EEUWE DIJK AND NELLY ECK 353

Ammonium toxicity and nitrate response of axenically grown *Dactylorhiza incarnata* seedlings. By EEUWE DIJK AND NELLY ECK 361

The biology of mycorrhiza in the Ericaceae XVIII. Chitin degradation by *Hymenoscyphus ericae* and transfer of chitin-nitrogen to the host plant. By SIMON J. KERLEY AND DAVID J. READ 369

Piceirhiza nigra, an ectomycorrhiza on *Picea abies* formed by a species of Thelephoraceae. By REINHARD AGERER, DÖRTE KLOSTERMEYER AND WOLFGANG STEGLICH 377

Diurnal water relations and gas exchange of two slash pine (*Pinus elliottii*) families exposed to chronic ozone levels and acidic rain. By J. D. JOHNSON, D. P. BYRES AND T. J. DEAN 381

Predictions of where minimal damage to jarrah roots could result in tree death. By E. M. DAVISON AND F. C. S. TAY 393

Cadmium toxicity in *Nostoc* UAM208: protection by calcium. By F. FERNANDEZ-PIÑAS, P. MATEO AND I. BONILLA 403

ERRATUM 409

DECEMBER 1995 VOLUME 131 NUMBER 4

Tansley Review No. 85 B chromosomes in plants. By R. NEIL JONES 411

On the cause of offspring superiority conferred by mycorrhizal infection of *Abutilon theophrasti*. By ROGER T. KOIDE AND XIAOHONG LU 435

Fungal biomass in roots and extramatrical mycelium in relation to macronutrients and plant biomass of ectomycorrhizal *Pinus sylvestris* and *Almus incana*. By ALF EKBLAD, HÅKAN WALLANDER, ROLF CARLSSON AND KERSTIN HUSS-DANELL 443

Nitrogen fixation by *Alnus incana* and nitrogen transfer from *A. incana* to *Pinus sylvestris* influenced by macronutrients and ectomycorrhiza. By ALF EKBLAD AND KERSTIN HUSS-DANELL 453

Mycorrhizal fungus propagules in the jarrah forest. II. Spatial variability in inoculum levels. By MARK C. BRUNDRETT AND L. K. ABBOTT 461

Allocation of carbon in mycorrhizal *Pinus ponderosa* seedlings exposed to ozone. By CHRISTIAN P. ANDERSEN AND PAUL T. RYGIEWICZ 471

An improved Solardome system for exposing plants to elevated CO_2 and temperature. By C. R. RAFAREL, T. W. ASHENDEN AND T. M. ROBERTS 481

Contrasting effects of elevated CO_2 and water deficit on two native herbs. By RACHEL FERRIS AND GAIL TAYLOR 491

Chemical changes in selected wetland plant species with increasing Fe supply, with specific reference to root precipitates and Fe tolerance. By R. E. D. SNOWDEN (*née* COOK) AND B. D. WHEELER 503

Growth responses of *Polytrichum commune* and *Hylocomium splendens* to simulated environmental change in the sub-arctic. By J. A. POTTER, M. C. PRESS, T. V. CALLAGHAN AND J. A. LEE 533

Nuclear differentiation in the filamentous caulonema of the moss *Funaria hygrometrica*. By KEITH I. KINGHAM, JEFFREY G. DUCKETT, MATTHEW C. P. GLYN AND ANDREW R. LEITCH 543

REFEREES 557